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**HEAVY BRIGADE C2:
IS THE CURRENT SYSTEM TOO COMPLEX?**

A Monograph

by

**Major Daniel J. Gilbert
Infantry**



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organization and structure to determine if expectations can be met with existing capabilities.

The monograph concludes that the current heavy brigade C2 system is complex and that it may fail to operate successfully on the high- and mid-intensity battlefield envisioned by FM 100-5. Failure of the system will result because the current force structure ~~does not~~ allow the heavy brigade headquarters to operate in a continuous combat environment and survive.

The findings imply that, although the current heavy brigade C2 doctrine is inconsistent, its intent is sound. Current manning and equipment authorization levels do not allow the doctrine to be executed as intended. Heavy brigade commanders must decide how to organize their brigade headquarters to conduct C2 functions and that decision will require the assumption of risk.

The current heavy brigade C2 system is not too complex to be viable. It is a key component of the U.S. Army's heavy force tactical C2 system. Should it fail, division and corps commanders will find tactical success on the AirLand battlefield difficult to achieve.

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ABSTRACT

HEAVY BRIGADE C2: IS THE CURRENT SYSTEM TOO COMPLEX? by
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The current heavy brigade command and control (C2) system has become very complex. The brigade headquarters may not be capable of making timely and accurate decisions, or of successfully supervising the resulting operations. It may be too large to move quickly or remain undetected and it may be too heavily dependent upon sophisticated electronic communications equipment. As a result, the headquarters may not accomplish its mission or survive on the high-and mid-intensity battlefield.

The purpose of this monograph is to examine the current divisional heavy brigade C2 system to determine if it has become too complex to be viable. It begins by looking at C2 theory to gain a common understanding of command, control, and the C2 system. It then describes current U.S. Army tactical C2 doctrine focusing on the heavy brigade. In order to determine just how complex the current heavy brigade C2 system is and if the system is too complex to be viable, it compares the current heavy brigade C2 doctrine with what history tells us about successful tactical C2. It then analyzes the current heavy brigade C2 organization and structure to determine if expectations can be met with existing capabilities.

The monograph concludes that the current heavy brigade C2 system is complex and that it may fail to operate successfully on the high- and mid-intensity battlefield envisioned by FM 100-5. But failure of the system will not be the result of an overly complex system; rather failure will result because the current force structure does not allow the heavy brigade headquarters to operate in a continuous combat environment and survive.

The findings imply that, although the current heavy brigade C2 doctrine is inconsistent, its intent is sound. Current manning and equipment authorization levels do not allow the doctrine to be executed as intended. Heavy brigade commanders must decide how to organize their brigade headquarters to conduct C2 functions and that decision will require the assumption of risk.

The current heavy brigade C2 system is not too complex to be viable. It is a key component of the U.S. Army's heavy force tactical C2 system. Should it fail, division and corps commanders will find tactical success on the AirLand battlefield difficult to achieve.

Table of Contents

	<u>Page</u>
I. Introduction.....	1
II. Theory.....	2
III. Doctrine.....	4
IV. Analysis and Evaluation.....	11
V. Conclusions.....	35
VI. Implications.....	36
VII. Summary.....	39
 Appendices:	
A. Brigade TAC and MAIN element configuration-extract from TC 101-5.....	41
B. Brigade TAC configuration-extract from TC 101-5.....	42
C. Brigade MAIN configuration-extract from TC 101-5.....	43
D. Brigade REAR configuration-extract from TC 101-5.....	44
E. Command post personnel, vehicle, and radio assignments.....	45
F. Orders preparation phase planning time calculations.....	50
G. Example European combat scenario.....	51
H. MAIN command post road movement column calculations.....	52
Bibliography.....	53

INTRODUCTION

The heavy brigade command and control (C2) system is a key component of the U.S. Army's heavy force tactical C2 system. Should it fail, tactical success on the AirLand battlefield will be difficult to achieve.

The current heavy brigade C2 system has become very complex. The brigade headquarters may not be capable of making timely and accurate decisions, or of successfully supervising the resulting operations. It may be too large to move quickly or remain undetected and it may be too heavily dependent upon sophisticated electronic communications equipment. As a result, the headquarters may not accomplish its mission or survive on the high- and mid-intensity battlefield.

The purpose of this monograph is to examine the current divisional heavy brigade C2 system to determine if it has become too complex to be viable. It begins by looking at C2 theory to gain a common understanding of command, control, and the C2 system. It then describes current U.S. Army tactical C2 doctrine focusing on the heavy brigade. In order to determine just how complex the current heavy brigade C2 system is and if the system is too complex to be viable, it compares the current heavy brigade C2 doctrine with what history tells us about successful tactical C2. It then analyzes the current heavy brigade C2 organization and structure to determine if expectations can be met with

existing capabilities.

This paper concentrates on the analysis of doctrine and organization. It uses the findings of previous historical research as a tool for comparative analysis. Evidence will be presented from periodicals, books, manuscripts, theses, U.S. Army manuals, exercise after action reports, and lessons learned at the National Training Center. It also relies on the author's professional experience. The analysis portion of this paper will answer the following questions: 1) Is the heavy brigade C2 system consistent with successful historical evidence? 2) Can the current heavy brigade headquarters accomplish its mission on the high- and mid-intensity battlefield? 3) How important is the heavy brigade C2 system to the success of the U.S. Army heavy force tactical battle? During the evaluation portion of the paper, logical conclusions and implications will be presented.

THEORY

What is theory and why is it important to us? Webster's dictionary defines theory as:

The general or abstract principles of a body of fact, a science, or an art.¹

Carl von Clausewitz helps us understand what theory does.

The primary purpose of any theory is to clarify concepts and ideas that have become, as it were,

¹Frederick C. Mish, ed., Webster's Ninth New Collegiate Dictionary (Springfield, Massachusetts: Merriam-Webster Inc., 1986), p. 1223.

confused and entangled.²

As long as there have been armies, commanders have had to deal with the problem of determining how best to defeat the enemy, how to communicate that decision to their subordinates, and how to control the army during battle. Over the ages many concepts and ideas have evolved.

Modern C2 theory is a group of principles that represent an effort to sort out the C2 concepts and ideas that have become confused and entangled over time. Modern C2 theory consists of the five basic principles of management that a military force must be able to perform to conduct successful operations. These management principles are: 1)plan, 2)organize, 3)direct, 4)coordinate, and 5)control. Modern C2 theory also includes the essential element of leadership. Leadership, provided by the military commander, brings direction, authority, and legality to the overall C2 process.

In order to employ combat power successfully on the modern battlefield there are various combat functions that must be performed and integrated. Furthermore, because of the size of modern armies and the scope of modern operations, one commander and staff cannot perform the required theoretical principles of C2 for the entire army. Therefore, subordinate commanders and staffs have been created to assist with these theoretical C2 principles.

²Carl von Clausewitz, On War (Princeton, N.J.: Princeton University Press, 1976), p.132.

The army has developed a C2 theory that recognizes the need to integrate five battlefield functional areas (BFA) horizontally at each tactical level of command. These BFA are: 1)maneuver, 2)air defense, 3)fire support, 4)intelligence & electronic warfare, and 5)combat service support. The theory acknowledges the requirement to vertically connect the various levels of command as well. This theory is found in conceptual form in the Army Command and Control Master Plan, Volume I, Concepts and Management. This plan establishes the Army Command and Control System.³ The Army Command and Control System (ACCS) is:

The aggregate means by which Army commanders employ and sustain military forces in a theater of operations. It consists of organizations, training and C2 doctrine.⁴

The tactical portion of ACCS is called the Army Tactical Command and Control System (ATCCS). ATCCS functions at Corps level and below.⁵

C2 theory then, provides the basis from which command and control doctrine, organization, and force structure are formulated.

DOCTRINE

³United States Army, Army Command and Control Master Plan, Vol I, Concepts and Management, Ft. Leavenworth, Kansas, October 1987, p. B-1.

⁴Ibid.

⁵Ibid., p. B-2.

What is doctrine? An article appearing in the United States Naval Institute Proceedings in Mar-Apr, 1915 and reprinted by the Art of War Colloquium in 1983 defined military doctrine as:

beliefs or teachings which have been reasoned from principles.... They are intended to be general guides to the application of mutually accepted principles, and thus furnish a practical basis for co-ordination under the extremely difficult conditions governing contact between hostile forces.*

FM 100-5 has this to say about doctrine:

Tactics, techniques, procedures, organizations, support structure, equipment and training must all derive from it. It must be rooted in time-tested theories and principles, yet forward-looking and adaptable to changing technologies, threats, and missions.⁷

Current U.S. Army tactical C2 doctrine is found in FM 101-5 Command and Control For Commanders and Staff, (Coordinating Draft), May/June 1988; TC 101-5 Staff Techniques and Procedures To Support Command and Control (Draft), 1 August 1988; and applicable organizational manuals such as FM 71-3 The Armored and Mechanized Infantry Brigade, May 1988. These documents draw on theoretical and historical bases, as well as pertinent JCS guidance, and the Army's

*Lt Cdr Dudley W. Knox, "The Role of Doctrine in Naval Warfare," Art of War Colloquium, Reprint from U.S. Naval Institute Proceedings, Carlisle Barracks, Pa., Nov 1983, p. 50.

⁷United States Army, Field Manual 100-5 Operations, Washington, D.C., 5 May 1986, p. 6.

keystone warfighting manual, FM 100-5 Operations, to provide tactical C2 doctrine for the Army.

What is command? JCS Pub 1 defines command as:

The authority that a commander in the military service lawfully exercises over subordinates by the virtue of rank or assignment. Command includes the authority and responsibility for effectively using available resources and for planning the employment of, organizing, directing, coordinating, and controlling military forces for the accomplishment of assigned missions.⁸

According to TC 101-5:

Command is a process by which you, the commander, infuse your will and intent among your subordinates. Command includes the authority and responsibility for effectively using available resources, and for planning the employment of, organizing, directing, coordinating, and controlling military forces to accomplish assigned missions.⁹

What is control? According to FM 101-5:

Control is the process through which you, with the assistance of your staff, direct battlefield activities.¹⁰

What is command and control? JCS Pub 1 defines command and control as:

⁸United States Army, FM 101-5 Command and Control For Commanders and Staff (Coordinating Draft), Ft. Leavenworth, Ks., May/June 1988, 1-1.

⁹United States Army, TC 101-5 Staff Techniques and Procedures To Support Command and Control (Draft), Ft. Leavenworth, Ks., 1 August 1988, p. 1-1.

¹⁰United States Army, FM 101-5 Command and Control For Commanders and Staff (Coordinating Draft), Ft. Leavenworth, Ks., May/June 1988, p. 1-1.

The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission.¹¹

JCS Pub 1 goes on to say that the decisive development and application of combat power is the goal of C2.¹²

How do we measure command and control effectiveness? FM 100-5 states that:

The ultimate measure of command and control effectiveness is whether the force functions more effectively and more quickly than the enemy.¹³

One final definition is required in order to continue. FM 101-5 discusses the seven battlefield operating systems calling them an "integral part of, the five BFA."¹⁴ These seven systems are: 1)maneuver, 2)fire support, 3)air defense, 4)intelligence, 5)combat service support, 6) mobility, countermobility, and survivability, and 7)C2. FM 101-5 explains that C2, mobility and survivability are included as part of each BFA. It contends that countermobility is an element of the maneuver BFA only. It also points out that C2 cannot be separated from the other battlefield operating

¹¹Ibid.

¹²Ibid., pp. 1-1 and 1-2.

¹³United States Army, Field Manual 100-5 Operations, Washington, D.C., 5 May 1986, p. 22.

¹⁴United States Army, FM 101-5 Command and Control For Commanders and Staff (Coordinating Draft), Ft. Leavenworth, Ks., May/June 1988, p. 1-13.

systems, because C2 connects the other six and allows them to conduct planning, directing, coordinating, and controlling activities.¹³

A brief description of the doctrinal heavy brigade command and control system is necessary before beginning the analysis. The description shall use the framework provided by FM 101-5: organizations, facilities, and processes. This paper concentrates on current organization and structure. It is concerned with two Tables of Organization and Equipment (TOE). These are the base and objective TOE. The base document provides the current personnel and equipment requirements for the heavy brigade headquarters, with a goal of ninety per cent of those requirements fielded in the force structure. The objective document provides the projected personnel and equipment requirements to be fielded in the next five to seven years.¹⁴

Organizations. The commander is probably the single most important individual in the organization. A quote from the 1941 version of FM 100-5 illustrates this point.

Whether the force is large or small, whether the functions of command are complex or simple, the commander must be the controlling head; his must be the master mind, and from him must flow the energy and the impulse which are to animate all under

¹³=Ibid.

¹⁴Rick Grant, "Interview," CACDA, Ft. Leavenworth, Ks., 31 October 1988.

him.¹⁷

A divisional heavy brigade is commanded by a Colonel (O-6).¹⁸

A heavy brigade staff consists of an executive officer, a coordinating staff, and a special staff. Subordinate and supporting units provide additional special staff representation and liaison officers when necessary. The brigade headquarters and headquarters company (HHC) provides logistics and operating personnel support for the brigade headquarters staff sections.¹⁹

Facilities. Equipment authorizations are found in appropriate TOE. Equipment will be described as necessary during the analysis portion of the paper. According to TC 101-5:

Battalions, brigades, divisions, and corps establish three command posts--tactical, main, and rear--to accomplish required C2 activities.²⁰

The heavy brigades' primary means of communication with subordinate and supporting units is the VRC-12-Series FM

¹⁷United States Army, FM 100-5 Operations, Washington, D.C., 22 May 1941, p. 23.

¹⁸United States Army, TOE 87042L200 (Base), Ft. Leavenworth, Ks., 29 August 1988, p. 1.

¹⁹United States Army, FM 71-3 Armored and Mechanized Infantry Brigade, Ft. Knox, Ky., May 1988, pp. 2-5 to 2-8.

²⁰United States Army, TC 101-5 Staff Techniques and Procedures To Support Command and Control (Draft), Ft. Leavenworth, Ks., 1 August 1988, p. 3-1.

radio in the secure mode. The primary means of communication with the division headquarters is the division area common user UHF multichannel system, also in the secure mode. Both of these systems are being replaced. The Single-Channel Ground and Airborne Radio System (SINCGARS) is a family of FM radios designed to defeat electronic warfare efforts by employing an electronic counter-countermeasure technique known as frequency hopping.²¹ The division area common user system is being replaced by the Multiple Subscriber System (MSE). MSE will help to improve command post survivability by allowing command posts to be remoted up to five kilometers away from the multichannel transmitter.²²

The current heavy brigade base TOE does not authorize any automation equipment. However, the objective TOE includes two tactical computer terminals (TCT), two tactical computer processors (TCP), and two tactical army combat service support computer systems. These computers form the first pieces of hardware designed to automate the heavy brigade C2 system. They represent the initial automation efforts for two of the five BFA (maneuver control and CSS control). Common hardware and software to automate all five

²¹Douglas Rogers, Donald McClow and Erick Wright, "Army Weaponry and Equipment," Army Green Book, October 1988, p. 359.

²²United States Army, Doctrine and Tactics Training Pamphlet: Mobile Subscriber Equipment, Ft. Leavenworth, Ks., November 1987.

BFA will not be fielded before the mid 1990's. An interim system, using the Maneuver Control System (MCS) software and nondevelopmental item hardware will be fielded initially. It will provide a limited capability to synchronize all five BFA. The current fielding schedule completes issue of the initial system by January 1991.²³

Processes. FM 71-3 describes the brigade C2 process as one which provides for "planning, directing, coordinating, and controlling the battle."²⁴ TC 101-5 describes this process as one through which the commander and staff interact to make decisions and to synchronize battlefield actions.²⁵

Having laid the groundwork in the introduction, theory, and doctrine chapters of this paper, it is now time to continue with the analysis.

ANALYSIS AND EVALUATION

Previous historical research and analysis tend to indicate that successful tactical command and control is ensured by those armies which: 1) develop workable, consistent, and commonly accepted doctrine, 2) conduct

²³United States Army, Army Command and Control Master Plan, Vol I, Concepts and Management, Ft. Leavenworth, Ks., October 1987, pp. 4-11 to 4-23.

²⁴United States Army, FM 71-3 Armored and Mechanized Infantry Brigade, Ft. Knox, Ky., May 1988, p. 2-2.

²⁵United States Army, TC 101-5 Staff Techniques and Procedures To Support Command and Control (Draft), Ft. Leavenworth, Ks., 1 August 1988, p. 4-2.

realistic training, 3) incorporate but do not become overly dependent upon available technology, 4) require tactical commanders to remain actively involved through their personal leadership in the conduct of battle, 5) stress small and highly effective staffs, and 6) allow subordinates freedom of action.²⁶

U.S. Army C2 doctrine for the heavy brigade is not consistent and is not workable with the current organizational structure. How quickly it is becoming accepted is difficult to determine, but available evidence indicates that there is great resistance to it in the field.

U.S. Army C2 doctrine for the heavy brigade is not consistent. Maj Stephen E. Runals argues in his recent monograph that "current U.S. Army doctrinal C2 publications are both internally and externally contradictory."²⁷ A review of the many U.S. Army C2 manuals in print confirms Maj Runals' finding.

This C2 doctrinal inconsistency was fully recognized by

²⁶The historical research and analysis referred to here was done by previous SAMS students and fellows. See SAMS monographs by Maj Stephen E. Runals, Maj Charles E. Burgdorff, Maj William S. Fennypacker, Maj Leon H. Rios, Ltc Dale E. Fincke, and MMAS thesis by Maj James H. Willbanks.

²⁷Stephen E. Runals, Command and Control, SAMS Monograph, Ft. Leavenworth, Ks., 2 December 1985, p. abstract.

the Army as early as 1981.²⁸ The new versions of FM 101-5 and TC 101-5 are attempts to alleviate the inconsistency. They are intended to incorporate the many separate manuals that have been produced by various U.S. Army organizations over the years. A review of FM 101-5, TC 101-5, and comparison with FM 100-5, FM 71-3, and ARTEF 71-3-MTP shows significant but not complete improvement. Inconsistencies still exist. Evidence will be presented later in the paper.

U.S. Army heavy brigade C2 doctrine is not workable with the current organizational structure. A U.S. Corps Commander, suggests that "we have two sets of doctrine: a requirements doctrine (what we will have in the future) and a capabilities doctrine (what we have now)." He advises that "commanders need to be careful to keep the two separate."²⁹

Additional evidence suggesting that the doctrine is not workable will be presented during the analysis of the current organization and structure.

Whether U.S. Army C2 doctrine is commonly accepted is difficult to determine. Acceptance of the new C2 doctrine is logically related to acceptance of AirLand battle doctrine as a whole. The army has been slow to accept AirLand battle

²⁸United States Army, Command Control System Program Review, Briefing Script, Ft Leavenworth, Ks., 14 December 1981, p. 19. See also Army C2 Master Plan, Vol I: Concepts and Management.

²⁹Comments by a current Corps Commander during visit to SAMS during academic year 1988-89.

doctrine. It was published as official doctrine in 1982 and there is still plenty of controversial discussion in professional journals and schools. FM 100-5 does not provide specific C2 guidance to the Army. Those specifics are being published now.³⁰ One can make a logical assumption that C2 doctrine published in 1988 will create a lively debate for several years to come.³¹

Realistic training is not conducted by all brigade headquarters. In fact, it is evident that brigade headquarters are not well trained to conduct combat operations. The most realistic training environment available today is the National Training Center (NTC) at Ft. Irwin, California. However, only fourteen brigade rotations a year are conducted and these for CONUS based units only.³² As a result the remaining eleven brigade headquarters must resort to other means of training in somewhat less than realistic environments. It is reasonable to expect that the units rotating to NTC are at least as well trained as the

³⁰See the following recent manuals: FM 71-3, May 1988; FM 101-5 (Coordinating Draft) May/June 1988; ARTEP 71-3-MTP (Final Draft) July 1988; TC 101-5 (Draft) August 1988.

³¹See John L. Romjue's From Active Defense to Airland Battle: The Development of Army Doctrine 1973-1982 for a discussion of the origins of AirLand battle.

³²General Maxwell R. Thurman, "Combat Training Center and Battle Command Training Programs," Army Green Book, October 1988, p. 88.

units that do not. Therefore, it is also reasonable to assume that training deficiencies noted during NTC rotations will probably apply to other brigade headquarters as well.

Six years of NTC experience have demonstrated that we have done a credible job of training at the battalion level. Our deficiencies are not with individual soldiers or crews but with mobile, mounted, maneuver and fire support skills, mainly at the battalion and brigade level.³³

An ongoing project by the Combined Arms Lessons Learned Cell at the NTC lists recurring brigade operational weaknesses. These weaknesses include problems with the following: 1)clearly expressing intelligence collection requirements, 2)seeing/visualization of the battlefield, 3)coordinating internal flanks, 4)use of available time by the staff, 5)roles of the command posts, 6)application of mass, and 7)heavy/light operations.³⁴

A quote from a recent NTC Lessons Learned pamphlet sums up the problem.

While we may intellectually understand the requirement to train as we fight, units participating at the National Training Center indicate that they do not always practise this training tenant. Units take shortcuts by not practicing proper command and staff procedures. They omit key players and their input. In short, some units are not training as they will fight.

³³General Maxwell R. Thurman, "Training to Fight and Win Now and Beyond the Year 2000," Army Green Book, Oct 1988, p. 89.

³⁴Copies of briefing slides obtained from LTC Heimgartner, Lynx Team, NTC, during interview at Ft. Irwin, California, 28 September 1988.

This lack of teamwork and cohesion is devastating at the National Training Center just as it would be in combat.³³

The heavy brigade headquarters is dependent upon electronic means of communication. A review of TOE 87042L200 reveals that the current heavy brigade base TOE contains thirty-two FM radios, two AM radios, and one radio teletypewriter (RATT). The base TOE would be augmented by a general support signal platoon from the division signal battalion equipped with and responsible for operating the division area common user multi-channel system (at least two UHF transmitters and sometimes three) and an additional RATT. The headquarters would be augmented by various liaison parties, bringing with them approximately 20 FM radios, 2 VHF radios, 2 HF radios, and 2 UHF radios.³⁴

The objective TOE shows a slight reduction in the number of emitters. It reduces the number of organic FM radios by five and eliminates the AM radios as well as the RATT units.

Most of the systems described operate in the secure mode making use of one of several secure devices such as the Speech Security Equipment: TSEC/KY-57 (commonly referred to

³³United States Army, NTC Lessons Learned, Ft. Leavenworth, Ks., 31 Jan 1986, p. 1.

³⁴United States Army, FM 71-3 Armored and Mechanized Infantry Brigade, Ft. Knox, Ky., May 1988, p. 6-12, and FC 71-3 The Armor and Mechanized Infantry Brigade, Ft. Knox, Ky. and Ft. Benning, Ga., October 1985, p. 2-53. See also Appendix E for calculations.

as the Vinson device), or the Speech Security Equipment Digital Subscriber Voice Terminal: TSEC/KY-68 (being fielded with the MSE).

The other means of communication available to the heavy brigade headquarters are limited. These include wire and messenger. However, it is obvious from the doctrine and the organizational structure that the brigade headquarters cannot depend on either wire or messenger as a primary means of communication. "Due to the fluidity of movement and distances between units," the use of wire will be limited.³⁷

The messenger service is limited by its size and speed.³⁸ The TOE authorizes only two liaison officer (LNO) parties. Each party consists of one officer and one driver.³⁹ The speed that the messenger and LNO teams can exchange information, without the use of radios, is limited to the travel time (by air or ground transportation) required to move between headquarters. Additionally, the divisional messenger service does not normally come forward of the

³⁷United States Army, FC 71-3 The Armor and Mechanized Infantry Brigade, Ft.Knox, Ky and Ft. Benning, Ga., October 1985, p. 2-55.

³⁸Ibid.

³⁹Ibid.

brigade REAR CP.⁴⁰

The brigade headquarters organization was designed to use electronic means as its principle method of communication. Both FC 71-3 and FM 71-3 acknowledge this point.⁴¹ It is obvious then, that should the primary electronic means of communication be interrupted or destroyed, the brigade headquarters has very limited capability to provide backup communications.

Current C2 doctrine does not consistently require commanders to remain actively involved through their personal leadership in the conduct of battle. FM 100-5 is quite clear that the role of personal leadership by commanders at all levels will be extremely important on the AirLand battlefield.⁴² FM 71-3 supports this principle.⁴³ Unfortunately, neither FM 101-5 nor TC 101-5 discuss the personal leadership role of the commander on the battlefield. Both documents tend to define command in the context of the

⁴⁰This observation is based on the author's experiences.

⁴¹United States Army, FC 71-3 The Armor and Mechanized Infantry Brigade, Ft. Knox, Ky., p. 2-52 and United States Army, FM 71-3 Armored and Mechanized Infantry Brigade, Ft. Knox, Ky., May 1988, p. 4-13.

⁴²United States Army, Field Manual 100-5 Operations, Washington, D.C., 5 May 1986, p. 14.

⁴³United States Army, FM 71-3 Armored and Mechanized Infantry Brigade, Ft. Knox, Ky., May 1988, p. 2-5.

C2 system.⁴⁴

Current doctrine does not stress the desirability of maintaining small staffs. Neither FM 101-5 nor TC 101-5 say much of anything about the size of staffs outside the context of "reducing the numbers of people and equipment in a CP" as an effective command post survivability measure.⁴⁵ However, current doctrine does stress the need for highly effective staffs.⁴⁶

Current doctrine does not consistently emphasize that allowing subordinates freedom of action is highly important. FM 100-5 does stress the importance of this principle on the Airland battlefield.⁴⁷ FM 71-3 is not quite as direct but does imply the desirability of allowing subordinates freedom

⁴⁴United States Army, FM 101-5 Command and Control For Commanders and Staff (Coordinating Draft), Ft. Leavenworth, Ks., May/June 1988, p. 1-1 and United States Army, TC 101-5 Staff Techniques and Procedures To Support Command and Control (Draft), Ft. Leavenworth, Ks., 1 August 1988, p.1-2.

⁴⁵United States Army, FM 101-5 Command and Control For Commanders and Staff (Coordinating Draft), Ft. Leavenworth, Ks., May/June 1988, p. 3-6.

⁴⁶Ibid., 2-3 and United States Army, TC 101-5 Staff Techniques and Procedures To Support Command and Control (Draft), Ft. Leavenworth, Ks., 1 August 1988, p. 1-3.

⁴⁷United States Army, Field Manual 100-5 Operations, Washington, D.C., 5 May 1986, pp. 4, 15, and 21.

of action.⁴⁸ Unfortunately FM 101-5 and TC 101-5 fall short of the mark again. Neither manual has much to say about the role of subordinate commanders in the C2 process except in a rather negative way.⁴⁹

The heavy brigade headquarters will have difficulties accomplishing its mission on the high- and mid-intensity battlefield because it cannot conduct continuous operations effectively beyond 72 hours and it is not survivable as currently configured.

FM 100-5 predicts "The high- and mid-intensity battlefields are likely to be chaotic, intense, and highly destructive."⁵⁰ Future battlefields will require rapid, violent, and unpredictable operations in a non-linear and continuous combat environment, at a "pace fast enough to prevent the enemy from taking effective counteractions."⁵¹ With this description in mind, the analysis now turns to what the heavy brigade headquarters must accomplish on this battlefield.

⁴⁸United States Army, FM 71-3 Armored and Mechanized Infantry Brigade, Ft. Knox, Ky., May 1988, pp. 1-2 and 2-1.

⁴⁹United States Army, FM 101-5 Command and Control For Commanders and Staff (Coordinating Draft), Ft. Leavenworth, Ks., May/June 1988, p. 2-6.

⁵⁰United States Army, Field Manual 100-5 Operations, Washington, D.C., 5 May 1986, p. 2.

⁵¹Ibid., p. 14.

The mission of the brigade headquarters is:

to provide command, control, and supervision of the tactical operations of the brigade and attached units... ...to provide logistics and operating personnel support for the brigade headquarters staff sections.⁵²

The heavy brigade headquarters is not properly staffed to conduct continuous operations beyond 72 hours. According to current doctrine the brigade establishes three command posts; the TAC, MAIN, and REAR. Each of these command posts must be prepared to conduct continuous operations. Neither TC 101-5 nor FM 71-3 provide strict guidance concerning the manning or equipping of these command posts, preferring to leave that to unit discretion. TC 101-5 does provide example configurations, but points out that these are merely examples.⁵³ Copies are at Appendices A through D. Analysis of these figures, published command post doctrine, and the brigade headquarters personnel authorizations reveal some interesting facts.

When the brigade headquarters conducts combat operations it may be spread out in seven different locations. These locations are: 1)command group, 2)TAC, 3)MAIN, 4)REAR, 5)HHC support area, 6)signal support area, and 7)retrans site. It

⁵²United States Army, FM 101-10-1/1 Staff Officer's Field Manual Organizational, Technical, and Logistical Data(Vol 1), Washington, D.C., October 1987, p. 1-147.

⁵³United States Army, TC 101-5 Staff Techniques and Procedures To Support Command and Control (Draft), Ft. Leavenworth, Ks., 1 August 1988, pp. F-1 to F-35.

is possible that all seven of these locations may need to conduct continuous operations simultaneously.

The brigade headquarters is authorized a total of 91 personnel (71 enlisted, and 20 officers). If a normal brigade headquarters slice of special staff and liaison personnel is added, the number of personnel working in the combat brigade headquarters operating locations will rise to approximately 132. When these personnel are spread out over six of the seven locations (retrans site is not operating independently) using the available doctrine as a guide, it can be determined that the sites will have approximately the number of personnel shown at Appendix E.

All of the brigade headquarters assigned and attached personnel have a full time job. There is no "fat" in the personnel authorizations. The normal procedure used to man command posts and provide continuous operations is some form of shift system.⁵⁴ However, not all personnel are available to man a shift. The command group and other key leadership personnel should not be placed on a shift. They need to be able to move freely around the battlefield. Specialists, one of a kind type personnel who must be available when needed, will normally end up working both shifts and sleeping when

⁵⁴United States Army, FC 71-3 The Armor and Mechanized Infantry Brigade, Ft.Knox, Ky and Ft. Benning, Ga., October 1985, pp. 2-39 to 2-40, and FC 71-6 Battalion and Brigade C2, Ft. Knox, Ky. and Ft. Benning, Ga., 1 Mar 1985, pp. 2-27 to 2-28.

possible. Finally, liaison personnel must be free to come and go as their duties demand. The analysis listed at Appendix E shows the results of subtracting the personnel that are not available to perform regular shift duties and who those personnel are. These calculations do not allow for guard and security requirements, quartering party requirements, work parties to build fighting positions, nor for operator maintenance on vehicles, generators, radios, and weapons. This work will probably be performed by the off-duty shift.

Command post movement takes time and requires labor. FM 101-5, TC 101-5, and FM 71-3 do not provide doctrinal guidance on how often brigade command posts should move. However, FC 71-3 suggested that the TAC should move every 8-12 hours.⁵⁵ A rule of thumb used by many units in the field is the MAIN should move at least every 24 hours.⁵⁶ Presumably these movements were during the conduct of defensive operations. A brigade conducting offensive operations may move its command posts more often. All personnel working at the command post are required to assist with the move. According to FC 71-3:

With practice and well defined SOPs a TOC can march order in less than 60 minutes and reassume its command and control functions within 30 minutes

⁵⁵Ibid., p. 2-24.

⁵⁶Based on the author's experiences.

afer arrival at the new location.⁵⁷

If one assumes a movement time of one hour, then the TOC will be out of action for about 2 1/2 hours per 24 hour period.

During this 2 1/2 hours no personnel will be sleeping.

During combat, operating shifts will probably be difficult to maintain.

To employ a work/rest schedule during the heat of battle is out of the question... ...Once the battle begins and there is contact with the enemy, sleep plans, job rotation, and rest periods may become impossible to execute.⁵⁸

Upon receipt of a new mission, the planning and orders preparation phase will probably require most, if not all personnel at the TAC/TOC to accomplish the necessary tasks in the limited time available. While there is no doctrinal time standard that a brigade headquarters must meet, the analysis at Appendix F provides us a planning figure of no more than nine hours from receipt of a mission until issuance of a brigade operations order. To meet this time standard and simultaneously conduct the ongoing combat operation, all personnel will be required to know and play their part. This means that very few, if any, of the brigade headquarters personnel will sleep during the nine hour orders preparation phase.

⁵⁷United States Army, FC 71-3 The Armor and Mechanized Infantry Brigade, Ft.Knox, Ky and Ft. Benning, Ga., October 1985, p. 2-31.

⁵⁸Ibid., p. 2-36.

Let us attempt to visualize how a heavy brigade may be employed on the modern battlefield as described in FM 100-5. A likely European scenario might look something like the one at Appendix G.

What has been described above is a 10 day period during which sleep schedules and routine shifts will be almost impossible to maintain. They will be interrupted by movements, combat, planning, other types of work parties and guard duties. Even if the sleep schedules can be maintained, the human body will not properly adjust to the new biological schedule for 20 to 30 days. Therefore, what little sleep the headquarters personnel do get, will not be entirely effective.

According to FC 71-3:

Performance and efficiency begin to deteriorate after 14 to 18 hours of continuous work and reach a low point after 22 to 24 hours... .After 24 hours of continuous duty, degradation of performance becomes evident. Most tasks involving perceptual skills begin to show a performance degradation after 36 to 48 hours without sleep. Personnel cease to be effective after 72 hours without sleep... .Biological adaptation to work/rest schedules may take from 20 to 30 days... .After an operation of 36 to 48 hours without sleep, 12 hours of sleep or rest is required to return personnel to normal functioning; however, fatigue may linger for 3 days. If a high level of activity, such as combat, is undertaken during this period, personnel may need two 12-hour rest periods to completely recover. After 72 or more hours without sleep, personnel may need as much as 2 or 3 days of rest to recover to normal performance.⁵⁷

⁵⁷Ibid.

Maj Thomas M. McGinnis comes to a similar conclusion in his 1987 study of continuous operations. He looks at laboratory studies, a recent Army analysis conducted by the Combined Arms Combat Developments Activity, a study conducted for the CGSC's Combat Studies Institute, and two recent Masters of Military Arts and Science theses. His conclusion is

The... . . .studies... . . .identify the physical parameters of approximately 48 hours of sustained combat and 72 hours of continuous operations as the limits of human capabilities to perform effectively.⁴⁰

When brigade headquarters staffing and the work schedule anticipated/required on the high- and mid-intensity battlefield are compared with the conclusions of the sources provided above, one finds the brigade headquarters personnel reaching the limits of their performance capabilities within 72 hours of continuous operations. In the scenario listed at Appendix G, that equates to about the time that combat will begin on Day 4.

The heavy brigade headquarters C2 system is not survivable on the high- and mid-intensity battlefield as currently employed. The MAIN is "highly vulnerable to

⁴⁰Maj Thomas M. McGinnis, Continuous Operations, The Time Dimension of Battle, SAMS monograph, Ft. Leavenworth, Ks., Dec 1987, pp. 5-6.

detection, disruption and destruction."⁴¹ Once the MAIN is disrupted or destroyed a lack of command post redundancy will result in the subsequent failure of the brigade C2 system.⁴²

The MAIN command post can easily be detected. The MAIN consists of the TOC, brigade signal support area, and the brigade HHC support area. Together these three locations consist of approximately 94 personnel, 6 tracked vehicles, 25 wheeled vehicles, 1 AM radio, 34 FM radios, 1 VHF radio, 1 HF radio, 3 UHF radios, and 1 RATT. The physical, thermal, and electronic signatures that this size command post emanates are almost impossible to hide.

According to FM 101-5, the physical signature consists of visual, audio, and radar signatures. FM 101-5 goes on to advise that well trained and disciplined troops can reduce this physical signature by properly using terrain, cover, and camouflage, and by paying attention to noise and light discipline and reducing personnel and vehicle movements to a

⁴¹ Julian M. Campbell Jr., Richard M. Scott, John R. Wallace, "Command Post Survivability," Military Review, September 1982, p. 12.

⁴²For an excellent discussion of command post organization, structure, and subsequent vulnerabilities see "Command Post Survivability" by Campbell, Scott, and Wallace, Military Review, Sept 1982.

minimum.⁴³ Of course these methods of reducing the physical signature are most effective when the command post is stationary. Even then they cannot be expected to be 100% effective and as previously stated, command posts must move. Remaining in one place too long invites discovery. It is ironic that the most often used solution for preventing detection is to move and to move often.

The act of movement significantly enhances the opportunities available for the enemy to detect the command post. The MAIN will probably be required to move at least every 24 hours. During this 2 1/2 hour movement period the MAIN will increase its physical signature immensely. Camouflage nets will be removed, light and noise levels will increase and the physical act of movement increases the chances of visual detection by enemy reconnaissance units or detection by radar. If the MAIN were to move in one convoy, along one route, it would require approximately 3.2 km of roadspace; or if it moves in two echelons on the same route, 1.6 km per column. If only the TOC and supporting signal site move in a single echelon on a single route, the column length will be 2.6 km; or 1.3 km per column if split into two

⁴³United States Army, FM 101-5 Command and Control For Commanders and Staff (Coordinating Draft), Ft. Leavenworth, Ks., May/June 1988, p. 3-7.

equal echelons.⁴⁴ These figures show the difficulty of erasing the physical signature of the MAIN.

The MAIN command post thermal signature is never erased. Almost everything that the command post is made of emits heat; vehicles, radios, generators, and people. Thermal signatures can be reduced by special kinds of paint, camouflage nets, and uniforms but never entirely eliminated.

The MAIN command post electronic signature is significant and easily detected and identified. The Soviets and their Warsaw pact allies have placed a great deal of emphasis on electronic warfare in recent years. They are capable of electronic direction finding and monitoring.⁴⁵ The heavy brigades' large number of radios and their routinely high usage rates have already been discussed. Training can reduce this electronic signature, but nothing will reduce it entirely other than avoiding all use of the electronic equipment.⁴⁶

The Soviets can disrupt or destroy the MAIN relatively

⁴⁴See Appendix H for calculations.

⁴⁵United States Army, NTC Lessons Learned, Ft. Leavenworth, Ks., 1 May 1986, p. 12, and D.B. Lawrence, "Soviet Radioelectronic Combat," Air Force Magazine, March 1982, pp. 88-91.

⁴⁶Leonard D. Holder, "Communications Alternatives," Armor, Sept-Oct 1977, pp. 52-55, and James E. Cates, "Electronic Signature Eraser," Infantry, Sept-Oct 1988, pp. 43-45, and Jack Silva, "Improving CP Survivability," Infantry, Nov-Dec 1987, pp. 23-27.

easily once it is detected. Disruption or destruction could be caused by a variety of means including electronic, indirect and direct fire systems.⁴⁷

The MAIN is vulnerable to indirect fire systems. The MAIN is composed of both armored and nonarmored vehicles. The M-577 tracked command vehicle does provide some protection from artillery and rocket fire. However, the canvas extensions do not. Additionally, not all personnel will be able to work under the armored cover of the M-577. Other protective measures must be taken. FM 101-5 suggests locating the command post inside buildings when possible or digging the command post underground to provide overhead cover. Both of these suggestions are workable. However, they will not always be possible, especially when movement is conducted daily, or there are a limited number of suitable buildings in the area of operation. Furthermore, it will probably never be possible to dig in all the soft-skinned wheeled vehicles that are an important part of the MAIN.

The MAIN is vulnerable to direct fire systems. The MAIN has very little organic protection against enemy direct fire systems. It has an assortment of machine guns and other small arms but no antitank weapons other than the M72 LAW. Its capability for early warning and local security is

⁴⁷United States Army, FM 100-2-1 The Soviet Army Operations and Tactics, Washington, D.C., 16 July 1984, pp. 15-1 to 15-6.

hampered by a lack of personnel to perform these duties. TOE 87042J4 acknowledges this weakness by recognizing the requirement to augment the brigade headquarters with a rifle platoon to "provide for security and antiaarmor protection."⁶⁸ However, even though this is a recognized need, it is rarely practised by units in the field.⁶⁹

The MAIN is vulnerable to disruption by electronic means. The Soviets have placed a great deal of emphasis on electronic combat. They have adequate means to disrupt the heavy brigade electronic systems. Their doctrine shows they fully intend to do so.⁷⁰

Findings of the July 1988 Defense Resources Board bring the problem into focus.

Soviet ability to locate and jam NATO command and control posts, then fix artillery fire on them is a major concern of the U.S. Defense Science Board...
...Soviet doctrine puts a high value on heavy artillery bombardment as well as a version of electronic warfare called radio-electronic combat, the ability to locate and jam enemy command and

⁶⁸United States Army, FM 101-10-1/1 Staff Officer's Field Manual Organizational, Technical, and Logistical Data(Vol 1), Washington, D.C., Oct 1987. p. 1-147.

⁶⁹Based on the author's observations.

⁷⁰United States Army, FM 100-2-1 The Soviet Army Operations, and Tactics, Washington, D.C., 16 July 1984, pp. 15-1 to 15-6.

control nodes.⁷¹

It is evident that some of our heavy brigade MAIN command posts will be detected, disrupted, and destroyed.

The brigade C2 system is not truly redundant. The TAC and REAR do not provide the C2 redundancy required. Neither command post is properly equipped or manned to do so. AirLand battle doctrine calls for the heavy brigade to employ three command posts: 1)the TAC, 2)the MAIN, and 3) the REAR. This doctrine calls for the:

TAC to conduct ongoing close operations; the MAIN to plan future operations, execute planned deep attacks, and coordinate combat, CS, and CSS requirements and directives from the brigade commander; the REAR to sustain current operations, forecast future CSS requirements, conduct detailed CSS planning, and serve as the entry point for units entering the brigade rear area.⁷²

Accordingly, the command posts are manned and equipped to accomplish these functions, resulting in an austere TAC, a large MAIN, and a REAR that is oriented on the sustainment mission. The only command post that can perform the crucial requirements for planning and synchronizing all seven battlefield operating systems is the MAIN. The TAC has no means of directly synchronizing air defense, aviation, engineer, or electronic warfare assets. The TAC can

⁷¹Army Times, "Soviet Guns A Problem For NATO," Army Times, Washington, D.C., 14 November 1988, p. 33.

⁷²United States Army, FM 71-3 Armored and Mechanized Infantry Brigade, Ft. Knox, Ky., May 1988, p. 2-5.

synchronize artillery fires directly only by voice and only when the FSO is present in the TAC. The REAR has no direct interface with the fire support, air defense, or engineer operating systems.⁷³ Command post redundancy is required to prevent the failure of the brigade C2 system. Simply put, another command post must be prepared to assume the roles of the MAIN. When the MAIN is disrupted or destroyed the brigade C2 system will fail, because no other command post can synchronize all seven battlefield operating systems.

The heavy brigade C2 system is critical to the overall success of the heavy brigade. Without it, battlefield synchronization will be difficult to achieve and without synchronization, the brigade engagement will be difficult to win. The authors of FM 71-3 recognized the importance of synchronization.

The key to victory in the brigade battle is its ability to synchronize... ...Synchronization of operations is required to obtain maximum combat power from the combined arms team. It requires a C2 system that can mass and focus the combat power of the brigade at the decisive time and place.⁷⁴

LTG E.S. Leland also recognized its importance.

Since there is a delay between time of request and arrival synchronized employment is both critical and difficult to effect... ...The consequences of a

⁷³Ibid., chapter 2.

⁷⁴Ibid., pp. 1-1 and 1-3.

lack of synchronization are so severe...?³⁵

The doctrinal command post configuration is not consistent with FM 100-5's vision of the future battlefield. FM 100-5 is clear in its description of a nonlinear, fluid, battlefield on which we must be able to act faster than the enemy in order to maintain the initiative. On such a battlefield the REAR is geographically positioned better than the MAIN or the TAC to C2 the brigade rear battle and may become the command post best suited to C2 other combat operations. An example of such an operation occurred during a recent BCTP exercise at Ft. Leavenworth. During the exercise an opportunity to conduct a counterattack occurred, but the TAC and the MAIN were not properly located to control it.

Accordingly, the division CG ordered the counterattack to be controlled by the REAR CP. In reality, this obviously necessitates that the REAR CP be manned and equipped to handle such contingencies.³⁶

The current heavy brigade command post configuration is functionally organized and the TOE is appropriately structured. It does not have sufficient personnel and equipment to allow the REAR command post the capability to C2 combat operations. Speed of action and ability to coordinate

³⁵LTG E.S. Leland, NTC Observations, Ft. Irwin, Ca., 20 Nov 1985, pp. 9 and 20..

³⁶DTAC CGSC, "JAD BCTP AAR", Unpublished Action Officer MFR, Ft. Leavenworth, Ks., undated.

all seven battlefield operating systems from several locations on the battlefield simultaneously will be required on the AirLand battlefield.

The success of the U.S. Army heavy force tactical battle is highly dependent upon the success of the heavy brigade engagement. Brigade commanders must win their engagements to allow division and corps commanders to achieve their goals.

Engagements are small conflicts between opposed maneuver forces... .Engagements are normally conflicts of a few hours' duration fought between divisions and smaller forces. Such engagements may or may not bring on battle... .Battles consist of a series of related engagements... .Battles occur when large forces--divisions, corps, and armies--commit themselves to fight for significant goals.⁷⁷

CONCLUSIONS

The current heavy brigade C2 system is not consistent with what has historically proven successful. The doctrine is inconsistent, not workable under the current structure, and not yet commonly accepted. Not all brigade headquarters are conducting realistic training. The heavy brigade headquarters has become overly dependent upon electronic communications that are vulnerable to detection and disruption. FM 101-5 and TC 101-5 do not emphasize the need to allow subordinates freedom of action. Both new manuals do stress the requirement for highly effective staffs, but not

⁷⁷United States Army, FM 100-5 Operations, Washington, D.C., 5 May 1986, p.10.

for keeping them small.

The analysis of the current heavy brigade C2 organization and structure indicates that the heavy brigade headquarters will have difficulty accomplishing its C2 mission. It is not properly staffed to conduct continuous operations beyond 72 hours and will have difficulty surviving on the high- and mid-intensity battlefield.

The research indicates that the current heavy brigade C2 system is complex and that it may fail to operate successfully on the high- and mid-intensity battlefield envisioned by FM 100-5. But failure of the system will not be the result of an overly complex system; rather failure will result because the current force structure does not allow the heavy brigade headquarters to successfully operate in a continuous combat environment and survive. Simply put, the doctrinal command post configuration and structure does not reflect FM 100-5's vision of the future AirLand battlefield.

IMPLICATIONS

Together, these conclusions imply that, although the current heavy brigade C2 doctrine is inconsistent, its intent is sound. The problem is one of force structure. Force structure improvements will be made during the next 5-7 years. However, these improvements will not significantly change the heavy brigade headquarters capability to conduct continuous operations nor will they significantly enhance the

TAC or REAR CP capabilities.

Today's heavy brigade commander must understand the consequences of attempting to organize and operate his C2 system in accordance with the current doctrine as constrained by the current TOE. The MAIN is vulnerable because it is too big and it has too many electronic emitters. The TAC and REAR are not equipped or manned to provide adequate C2 continuity. The headquarters may exhaust itself within 72 hours of continuous operations.

Fielding of MSE, SINCGARS, and MCS in the near future will help to reduce the electronic signature of all three command posts and through automation, improve the operating efficiency of the system as a whole. But none of these technological fixes will significantly change the ability of the brigade headquarters to conduct continuous operations beyond 72 hours. Nor will they significantly enhance the ability of the TAC and REAR command posts to plan for and synchronize combat operations. Continuous operations beyond 72 hours require more people or less jobs. That means reducing the number of command posts or augmenting the brigade headquarters company with personnel above the TOE requirement. Providing the TAC and REAR command posts a truly redundant capability means providing these command posts with the means to interface directly with all seven battlefield operating systems. In the absence of an automated system that is capable of providing this interface,

properly equipped LNO parties will be required.

Division and corps commanders must also understand these current heavy brigade C2 limitations. Decisions to employ brigade headquarters in continuous operations beyond 72 hours involve risk. If the brigade C2 system collapses, a successful outcome of the brigade engagement is doubtful. A brigade defeat may unhinge the division and corps commanders' battles as well. The army must repair the structure of the heavy brigade headquarters or risk the consequences on the high- and mid-intensity battlefield.

The obvious problem that these implications present is that of increasing the size of the brigade headquarters to improve C2 continuity and the capability to conduct continuous operations. Indeed, the overall size of the headquarters would increase, but overall headquarters size is not the important issue here. The important issue is the size and structure of the individual command posts. By redistributing personnel and equipment between the current command posts and adding additional LNO parties where necessary, the size of the MAIN can be reduced, while increasing the size of the TAC and REAR. The resulting CP configuration would be one which provides better C2 redundancy, and a better capability to conduct continuous operations. Each CP would be a small but highly efficient and self contained staff (if properly trained). Thus, loss of any one of these CP's would damage the capability of the

brigade headquarters to plan and conduct combat operations, but it would not cause a complete collapse of the brigade headquarters ability to do so. Three CP's that are smaller than the current MAIN, but larger than the current TAC and REAR would be easier to move, easier to protect, capable of more independent and continuous operations, and certainly not significantly more difficult to support than the current structure. The whole issue boils down to cost; faces, spaces, and hardware. You get what you pay for. A savings in dollars today, results in an increased risk on the battlefield of tomorrow.

SUMMARY

This paper began by looking at C2 theory to gain a common understanding of command, control, and the C2 system. It then described current U.S. Army C2 doctrine, focusing on the divisional heavy brigade. The analysis of the current heavy brigade doctrine and force structure used periodicals, books, manuscripts, theses, U.S. Army manuals, exercise after action reports, and lessons learned at the National Training Center. It has revealed that the intent of the current C2 doctrine for the heavy brigade is sound. However, current manning and equipment authorization levels do not allow the doctrine to be executed as intended. Heavy brigade commanders must decide how to organize their brigade headquarters to conduct C2 functions and that decision will require the assumption of risk.

The current heavy brigade C2 system is not too complex to be viable. It is a key component of the U.S. Army's heavy force tactical C2 system. Should it fail, division and corps commanders will find tactical success on the AirLand battlefield difficult to achieve.

Appendix A

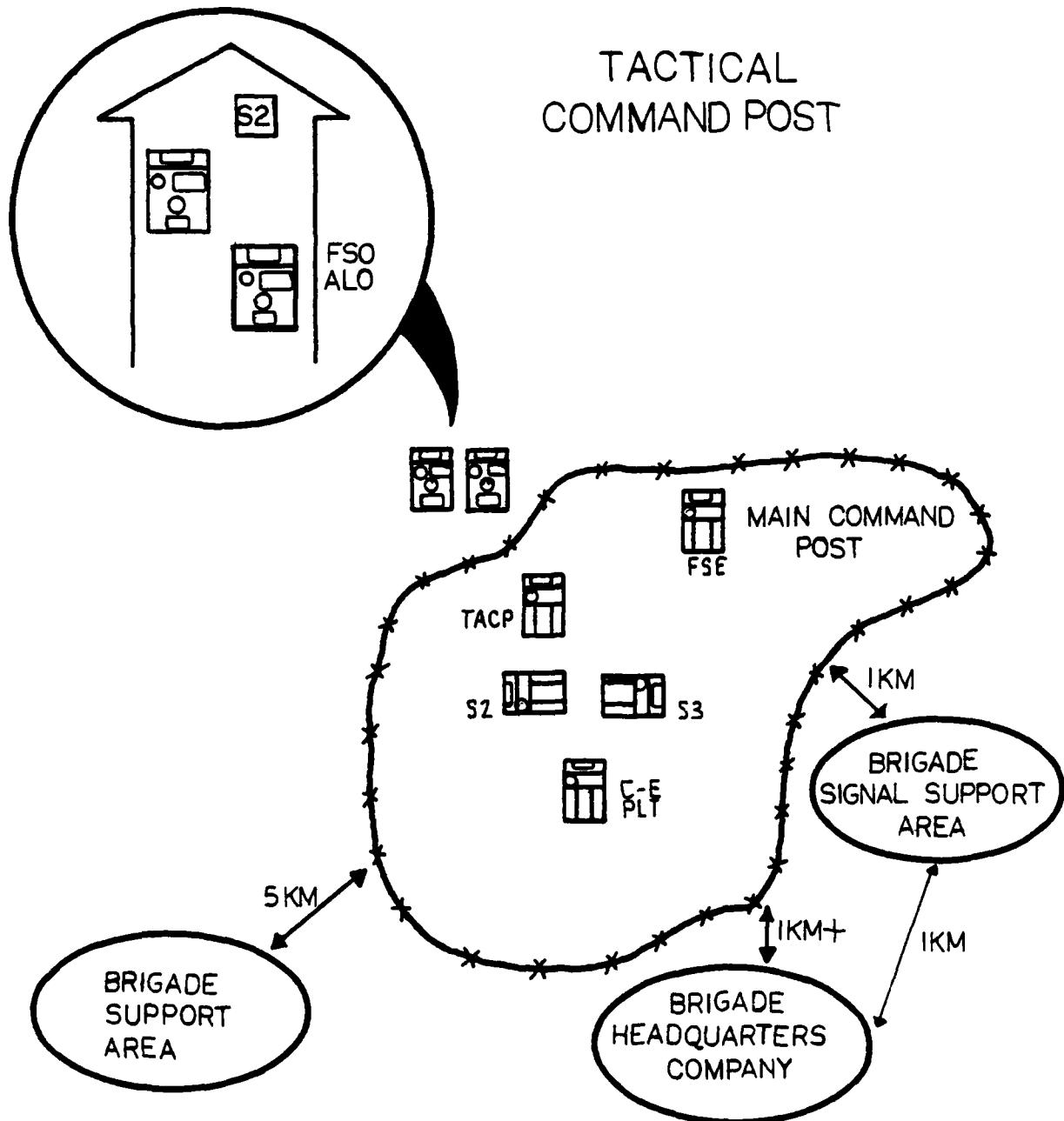
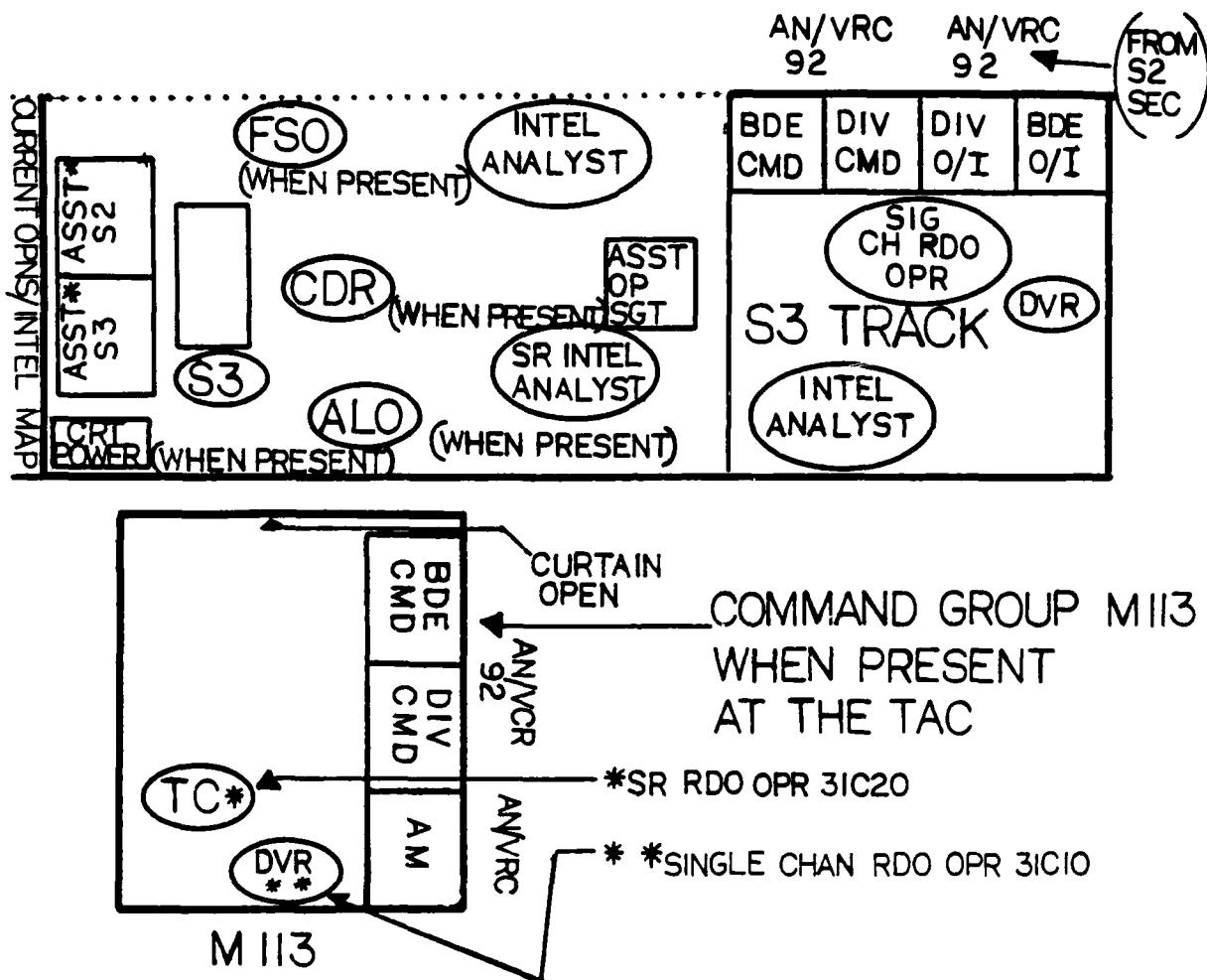


Figure F-25. Brigade TAC and MAIN element configuration. 78

78 United States Army, TC 101-5 Staff Techniques and Procedures To Support Command and Control (Draft), Ft. Leavenworth, Ks., 1 August 1988, p. F-30.

Appendix B



* Remote FM-Secure Radio

Figure F-26. Brigade TAC configuration. 79

Appendix C

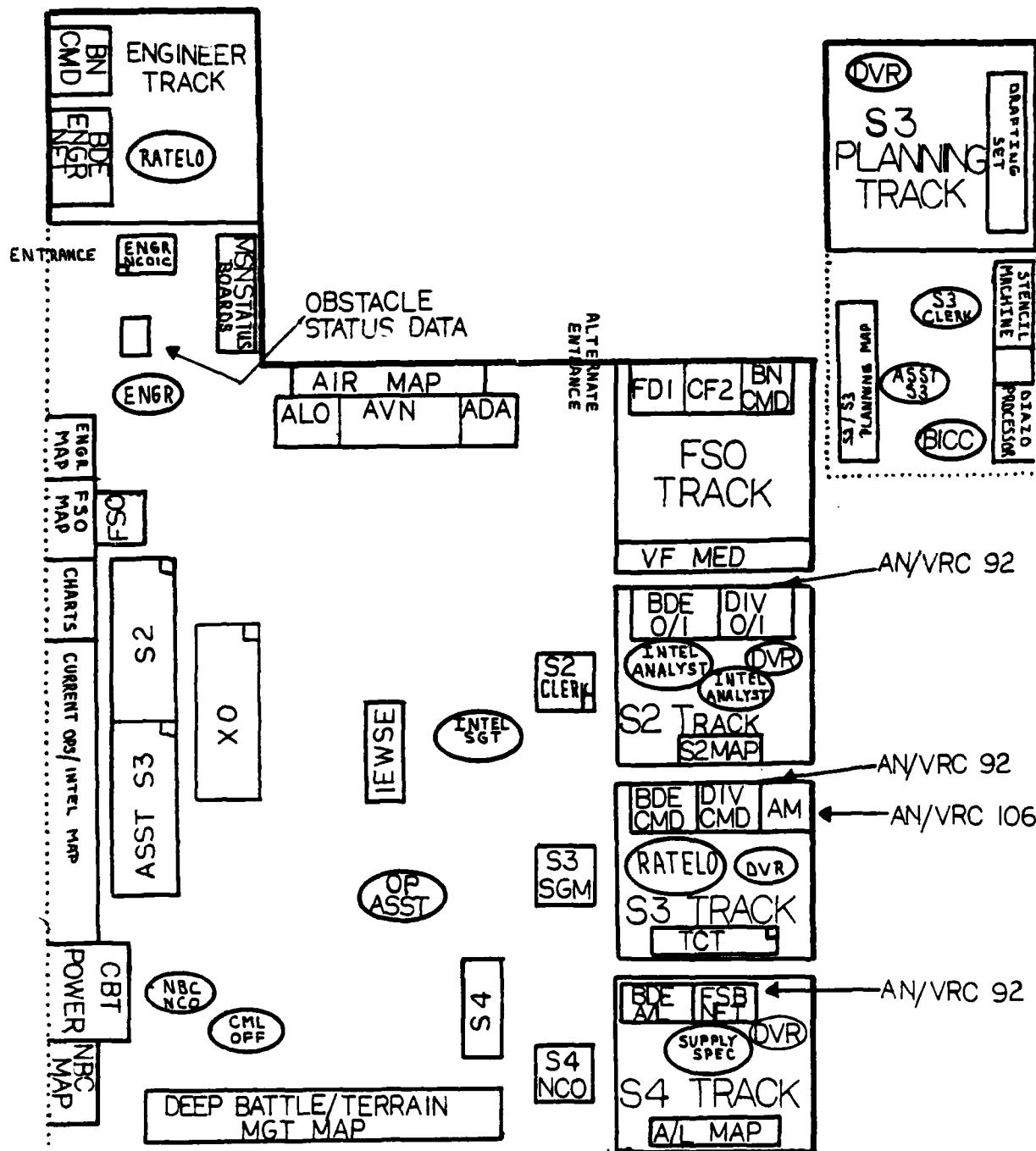
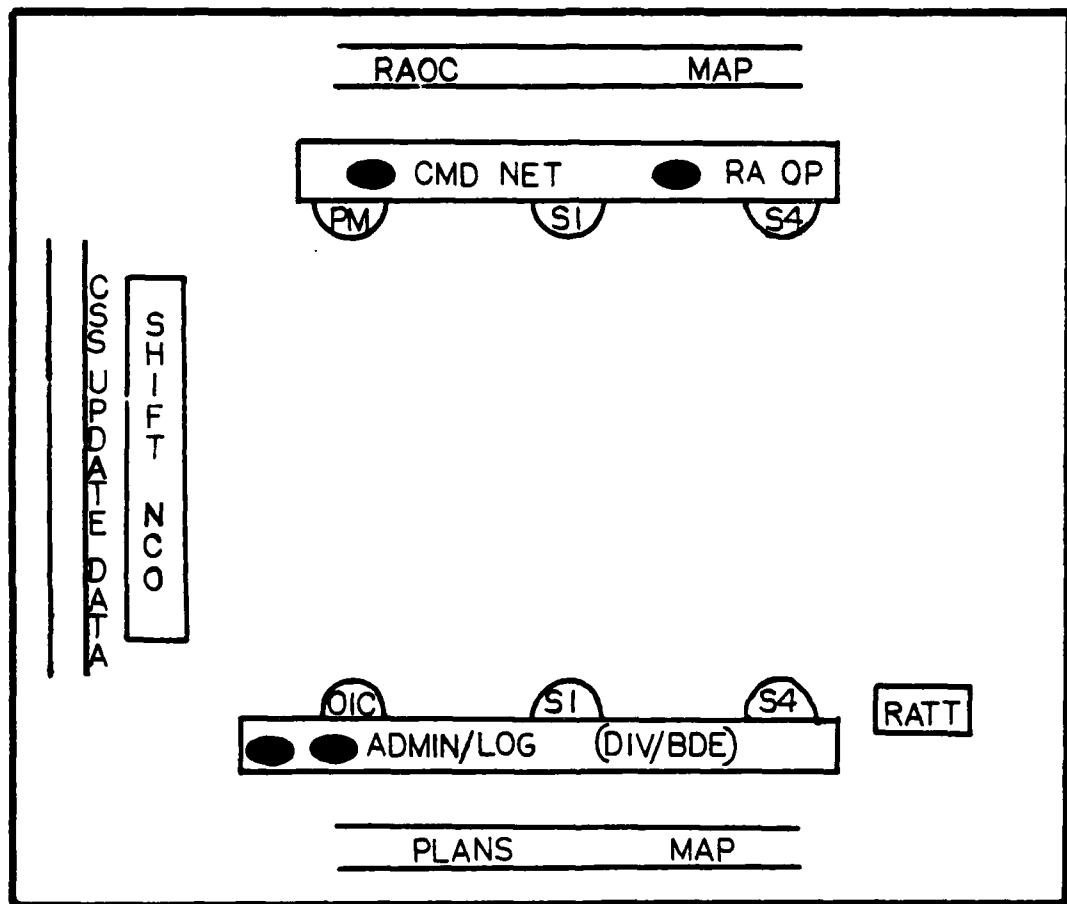


Figure F-28. Brigade MAIN configuration. 80

Appendix D



GP MEDIUM/M577 EXTENSION

Figure F-30. Brigade REAR configuration. 81

81 Ibid., p. F-35.

Appendix E: Command post personnel, vehicle, and radio assignments.

1. HHC INF DIV (MECH) BDE TOE 87042L200 (Base), dated 29 August 1988.
2. FC 71-6 Battalion and Brigade Command and Control, dated 1 March 1985.
3. FC 71-3 The Armor and Mechanized Infantry Brigade (Coordinating Draft), dated October 1985.
4. FM 71-3 Armored and Mechanized Infantry Brigade, dated May 1988.
5. TC 101-5 Staff Techniques and Procedures To Support Command and Control (Draft), dated 1 August 1988.
6. The examples listed below use the above list of references to assign location of personnel, vehicles, and radios. However, none of the above references are exactly the same. I have relied primarily on the example illustrations in TC 101-5 and adjusted where necessary based on the authorized TOE allowances and my own experience. Exceptions are noted. The intent is to attempt to portray what the doctrine establishes as a guideline.

COMMAND GROUP

Para/Line	Description	Grade	Mos	V/R	Shift
01 01	Commander	O-6	11C00	M-113	B
01 11	Sr Rdo Opr	E-5	31C20	2 FM	B
01 14	Scout	E-4	11B10		B
01 12	Rdo Opr	E-4	31C10	1 AM	B
	FSCOORD	O-5		1 1/4 T	B
	Rdo Opr	E-4		2 FM	B
	ALO	O-4	USAF	1 1/4 T	B
	TACCS	E-6	USAF	1 FM	B
				1 VHF	
				1 HF	
				1 UHF	

Command Group Personnel Subtotal = 8

TAC

04 01	Asst S-3	O-3	11C00		D
04 08	Asst Ops Sgt	E-7	11B40		N
04 16	Scout/Driver	E-4	11B10	M-577	N
04 17	Rdo Opr	E-3	31C10	2 FM	D
03 01	Asst S-2	O-3	35D00		N
03 02	Sr Intell Anal	E-6	96B30		D

03 06	Intell Anal	E-4	96B10	2 FM	D
01 07	S-3	O-4	11C54	1/4 T	B
01 15	Rdo Opr	E-3	31C10	2 FM	B

TAC Personnel Subtotal = 9

MAIN

TOC

01 02	XO	O-5	12A00	1 FM	B
01 13	Driver	E-3	11B10	1/4 T	B
01 10	CSM	E-9	00Z50		B
01 06	S-2	O-4	35D00	1 1/4 T	D
03 08	Intell Anal	E-3	96B10	1 FM	D
03 03	Sr Intell Anal	E-6	96B30		N
03 04	Intell Anal	E-5	96B20		D
03 04	Intell Anal	E-5	96B20		N
03 05	Clerk Typist	E-4	71L10	M-577	D
03 07	Tac Intell Off	O-3	35D00	2 FM	N
03 09	Scout	E-4	11B10		N
04 02	Asst S-3	O-3	12A00		P
04 03	Asst S-3	O-2	11C00		N
04 04	Asst S-3	O-2	74B00		D
04 07	Ops Sgt	E-9	11Z50		D
04 09	NBC NCO	E-7	54B40		N
04 10	Ops Asst	E-5	19K20	M-577	N
				3 FM	
04 12	Rdo Opr	E-5	31C20	M-577	D
				1 AM	
				3 FM	
04 13	Clerk Typist	E-4	71L10	1/4 T	D
				1 FM	
04 15	Rdo Opr	E-4	31C10	1 FM	N
04 16	Scout	E-4	11B10		D
04 16	Scout	E-4	11B10		N
06 01	Commander	O-3	02A00	1 FM	B
06 07	Driver	E-3	11B10	1/4 T	B
04 05	Liaison Off	O-3	11C00	1 FM	B
04 11	Ops Sgt	E-5	11B20	1/4 T	B
04 06	Liaison Off	O-3	12A00	1 FM	B
04 14	Ops Asst	E-4	11B10	1/4 T	B
	FSO	O-4		1 FM	D
	Fire Sup Spec	E-4		1/4 T	D
	Fire Sup Spec	E-7		2 FM	N
	Fire Sup Spec	E-4		M-577	N
	ALO	O-3	USAF	1 1/4 T	B
	TACCS	E-4	USAF	1 FM	B
	TACCS	E-4	USAF	1 VHF	B
				1 HF	
				1 UHF	
	Bde Engr	O-4		1 FM	B
	Driver	E-3		1/4 T	B
	Ops NCO	E-7		2 FM	D
	Cbt Con For	E-6		M-577	N

ADA LNO	O-2	2 FM	D
ADA LNO Sgt	E-5		N
Driver	E-3	1/4 T	D
Avn LNO	O-3	2 FM	B
Driver	E-3	1/4 T	D
IEW LNO	O-3		D
IEW NCO	E-6	2 FM	N
Driver	E-3	1/4 T	D
Stf Weather Sgt	E-6	1 FM	D
Driver	E-3	1/4 T	D

TOC Personnel Subtotal = 49

<u>Bde Signal Support Area</u>				
01 03	CE Off	O-4	25C00	1/4 T
09 01	Comms Ops Ch	E-8	31Z50	1 FM
09 02	RDO Tm Ch	E-6	31C30	
09 03	Auto Sw Sys Tm C	E-5	36M20	
09 04	Cmbt Sig Tm Ch	E-5	31K20	1/4 T 4 FM
09 05	Auto Sw Sys Opr	E-4	36M10	
09 07	UL Comm Maint	E-4	31V10	
09 07	UL Comm Maint	E-4	31V10	
09 08	Wire Installer	E-4	31K10	1/4 T
09 09	Auto Sw Sys Opr	E-3	36M10	1 1/4 T
09 11	Wire Installer	E-3	31K10	
09 11	Wire Installer	E-3	31K10	
	Plt Ldr	O-2		1 FM
	Plt Sgt	E-7		
	TM1 Team Ch	E-5	31M20	
	TM1 Eq Op	E-4	31M10	1 UHF
	TM1 Op	E-3	31M10	1 1/4 T
	TM2 Team Ch	E-5	31M20	
	TM2 Eq Op	E-4	31M10	1 UHF
	TM2 Op	E-3	31M10	1 1/4 T
	RDO TTY Ch	E-5	31C20	
	RDO TTY Op	E-4	31C10	1 RATT
	RDO TTY Op	E-4	31C10	1 1/4 T

Bde Signal Support Area Personnel Subtotal = 23

<u>HHC Support Area</u>				
06 02	XO	O-2	02A	1 FM
06 03	1SG	E-8	11B5M	
06 04	Supply Sgt	E-6	76Y30	
06 05	Armorer	E-4	76Y10	1 1/4 T
06 06	Unit Clerk	E-4	75B10	2 1/2 T
07 01	Mtr Sgt	E-7	63B40	
07 02	FLL C1k	E-5	76C20	
07 03	Rec Veh Opr	E-5	63B20	M-578
07 04	Track Veh Mech	E-5	63Y20	
07 05	Lt Wh Veh Mech	E-4	63B10	2 1/2 T

07	06	Pwr-Gen Eq Rep	E-4	52D10		N
07	07	Rec Veh Opr	E-4	63Y10	2 1/2 T	N
07	08	Lt Wh Veh Mech	E-3	63B10		D
07	09	Rec Veh Opr	E-3	63Y10		D
07	10	Track Veh Mech	E-3	63Y10		D
08	01	Food Service Sgt	E-7	94B40		D
08	02	First Cook	E-6	94B30		D
08	03	Cook	E-5	94B20		D
08	04	Cook	E-4	94B10		D
08	04	Cook	E-4	94B10		N
08	05	Cook	E-3	94B10	2 1/2 T	N

HHC Support Area Personnel Subtotal = 21
 MAIN Command Post Personnel Total = 93

REAR

01	05	S-1	O-4	11C41	1 FM	B
02	01	PSNCO	E-7	75Z40	1 1/4 T	N
02	02	Snr Legal NCO	E-7	71D40		D
02	03	Snr Chap Asst	E-6	71M30		N
02	04	Clerk Typist	E-4	71L10	1/4 T	B
10	01	Snr Chap Asst	E-6	71M30	1/4 T	D
01	04	Chaplain	O-4	56A00		B
01	09	Field Surgeon	O-4	62B00		B
01	08	S-4	O-4	11A00		B *
05	01	Asst S-4	O-3	91B00		D
05	01	Asst S-4	O-3	91B00		N
05	02	Ch Sup Sgt	E-8	76Z5K		D
05	03	Food Serv Supv	E-8	94B50		B
05	04	Scout	E-4	11B10	M-577	N*
					2 FM	
05	05	Supply Sp	E-3	76Y10	1/4 T	B*
					1 FM	
09	06	Rdo TTY Opr	E-4	31C10	M-577	D
09	06	Rdo TTY Opr	E-3	31C10	1 RATT	N
09	11	Wire Installer	E-3	31K10		D
		Civ Affairs Off	O-3		1 FM	B
		Driver	E-3		1/4 T	B
		MF Plt Ldr	O-2		2 FM	B
		Driver	E-3		1/4 T	B

REAR Personnel Subtotal = 22
 TOTAL Assigned and Attached Personnel = 132

ROLL UP OF ELECTRONIC EMITTERS

Type	Cmd	Grp	TAC	MAIN	To Bde	HHC	Total
AM		1		1			1
FM		2	6	20	4	32	
RATT					1		1

		<u>Attached LNO Parties</u>			
FM	3	14	3		20
VHF	1	1			2
HF	1	1			2
UHF	1	3	1		5
RATT		1			1
		<u>Total Roll Up</u>			
AM	1	1			2
FM	5	6	34	7	52
VHF	1	1			2
HF	1	1			2
UHF	1	3	1		5
RATT		1	1		2
TOTAL	9	6	41	8	64

* These personnel and the S-4 M-577 are located at the MAIN in TC 101-5 example (see Appendix C). The intent of locating these personnel at the MAIN is probably to provide for better coordination and synchronization of combat and sustainment operations. This is a worthy goal. I have chosen to locate them at the REAR in my computations, because I believe that locating them at the MAIN is not practical and is not practiced by units in the field. The REAR is limited in its capabilities. The MAIN is already very large. Both of these problems are exacerbated by locating these personnel at the MAIN. A better solution might be to assign a CSS LNO party to the MAIN (requires additional personnel and equipment authorization).

**** Codes**

B = Both/Neither
 D = Shift 1
 N = Shift 2
 P = Plans Both/Neither

Appendix F: Orders Preparation Planning Time-Calculations.

1. The calculations below are based upon two assumptions.

a. Assumption #1: U.S. Army units will attempt to use the 1/5 - 4/5 rule for allocating planning time to subordinate headquarters. This rule allows for a headquarters to use 1/5 of the total time available to plan its operation. Thus, leaving 4/5 of the total time available to subordinate units to make their plans.

b. Assumption #2: A common rule of thumb used by units in the field, and the U.S. Army Command and General Staff College is that a Corps headquarters will have 72 hours from receipt of a new mission until execution must begin. Of course it may be less, but this figure gives us a place to begin.

2. Calculations.

Corps HQ

Total Time Available	= 72 hrs
1/5 of total time	= 14.4 hrs
4/5 of total time	= 57.6 hrs

Division HQ

Total Time Available	= 57.6 hrs
1/5 of total time	= 11.52 hrs
4/5 of total time	= 46.08 hrs

Brigade HQ

Total Time Available	= 46.08 hrs
1/5 of total time	= 9.21 hrs Available for orders preparation and planning.

Appendix G: Example European Combat Scenario.

- DAY 1 Deploy from garrison to FAA or GDP.
- DAY 2 Prepare defense.
- DAY 3 Continue preparations.
- DAY 4 Conduct defense.
- DAY 5 Conduct defense.
- DAY 6 Plan counterattack/execute relief in place or withdraw to break contact.
- DAY 7 Conduct movement/execute counterattack.
- DAY 8 Assume hasty defense.
- DAY 9 Withdraw.
- DAY 10 Receive new mission.

Appendix H: MAIN Command Post Road Movement Column Calculations.

1. The calculations below use an average vehicle length of 3 meters and 100 meters between vehicles in a column.

TOC

M-577 = 5	3m x 18 = 54 meters
1/4 Ton = 11	100m x 18 = 1800 meters
1 1/4 Ton = 2	column length = 1854 meters
subtotal = 18 vehicles	

Bde Sig Support Area

1/4 Ton = 3	3m x 7 = 21 meters
1 1/4 Ton = 4	100m x 7 = 700 meters
subtotal = 7	column length = 721 meters

HHC Support Area

M-5778 = 1	3m x 6 = 18 meters
1 1/4 Ton = 1	100m x 6 = 600 meters
2 1/2 Ton = 4	column length = 618 meters
subtotal = 6	

MAIN Total

M-577 = 5	3m x 31 = 93 meters
M-578 = 1	100m x 31 = 3100 meters
1/4 Ton = 14	column length = 3193 meters
1 1/4 Ton = 7	= 3.2km
2 1/2 Ton = 4	
total = 31	

TOC & Bde Sig Site combined column length
 1854m + 721m = 2575m or 2.6km

BIBLIOGRAPHYBooks

Beaumont, Roger A., The Nerves of War: Emerging Issues In and References to Command and Control. Washington, D.C.: AFCEA International Press, 1986.

Bolger, Daniel P., Dragons at War, 2-34 Infantry in the Mojave. Novato, Ca.: Presidio Press, 1986.

Clausewitz, Carl von, On War. Princeton, N. J.: Princeton University Press, 1976.

Creveld, Martin van, Command In War. Cambridge, Mass.: Harvard University Press, 1985.

Du Picq, Ardent, Battle Studies. Harrisburg, Pa.: Stackpole Books, 1987.

English, John A., On Infantry. New York: Praeger, 1981.

Gordan, Don, E., Electronic Warfare-- Element of Strategy and Multiplier of Combat Power. New York: Pergamon Press, 1981.

Jomini, Baron de, The Art of War. Philadelphia, Pa.: Lippincott, 1862.

Littlebury, F. E., Invisible Combat: C3CM: A Guide For The Tactical Commander. Washington, D.C.: AFCEA International Press, 1986.

Luttwak, Edward N., and Horowitz, Daniel, The Israeli Army. Cambridge, Mass: Abt Books, 1983.

Mish, Frederick, C., ed., Webster's Ninth New Collegiate Dictionary. Springfield, Mass: Merriam-Webster Inc., 1986.

Nye, Roger H., The Challenge Of Command: Reading for Military Excellence. New York: Avery Puab. Co., 1986.

Ricci, Fred J., U.S. Military Communications: a C3I Force Multiplier. Rockville, Mo.: Computer Science Press, 1986.

Simpkin, Richard E., Human Factors in Mechanized Warfare. Oxford: Brassey's Publishing Limited, 1982.

Willcox, A. M., Command, Control, & Communications (C3). Oxford: Brassey's Defence Publishers, 1983.

Woods, David L., A History of Tactical Communications Techniques. New York: Arno Press, 1974.

Periodicals and Articles

Allard, Kenneth, "History, Technology, and the Structure of Command," Military Review, Nov 1981, pp. 4-9.

Anderson, Gary W., "Command and Control Debate: Communications Provide the Key," Military Review, Nov 1981, pp. 28-32.

Army Times, "Soviet Guns A Problem For NATO," Army Times, Washington, D.C., 14 Nov 1988, p. 33.

Babcock, James, "Tactical Communications-The Linkage Between C2 and I," Signal, Nov 1980, pp. 11-15.

Beaumont, Roger, "The Tactical Spectrum and C3 State Variance: Accommodating Uncertainty," Signal, March 1981, pp. 45-49.

Boyd, Kenneth, D., "SICPS-Standardized Integrated CP System," Infantry, Sept-Oct 1988, pp. 41-43.

Boyes, Jon L., "Technology, Communications, and You," Signal, January 1982, pp. 47-49.

Campbell, Julian, M. Jr., Scott, Richard, M., and Wallace, John, R., "Command Post Survivability," Military Review, Sep 1982, pp. 12-20.

Cates, James, E., "Electronic Signature Eraser," Infantry, Sep-Oct 1988, pp. 43-45.

Clark, Wesley, K., "The Penetration Bde Task Force in The Attack," Military Review, Oct 1988, pp. 38-48.

Cushman, John J., "AirLand Battle Mastery and C2 Systems," Signal, March 1983, pp. 45-51.

Dickson, Hillman, "C3--Eyes, Ears, Nerves and Brains of our War Fighting Structure," Signal, May-June 1981, p. 29.

Gorman, Paul, "A Command Post is Not a Place," CGSOC Command and Control readings, 1984, pp. 84-85.

Greenhill, John, "Problems Inherent in the Army C3 System," Military Electronics Countermeasures, Jan 1982, pp. 26-31.

Holder, Leonard D., "Communications Alternatives," Armor, Sept-Oct 1977, pp. 52-55.

Humphrey, Vernon W., "Winning at the NTC: Parts 1-7," Infantry, Nov/Dec 83-Nov/Dec 84.

Humphrey, Vernon W., "NTC: Command and Control," Infantry Magazine, Sept-Oct 1984, pp. 36-38.

Johnston, E.S. Maj, "Field Service Regulations of the Future, Part II," Review of Military Literature, Sept. 1936.

Kirchhofer, Kirk H., "Military Command and Control--An Overview," International Defense Review, Vol. 16, No. 1 1983, pp. 23-30.

Knox, Dudley, W. Lt Cdr, "The Role of Doctrine in Naval Warfare," United States Naval Institute Proceedings, Vol. 41 Mar-Apr 1915, Reprinted by Art of War Colloquium, Nov 1983.

Lawrence, D. B. "Soviet Radioelectronic Combat," Air Force Magazine, March 1982, pp. 88-91.

Long, Dennis H., "Command and Control-Restoring the Focus," Military Review, Nov 1981, pp. 44-48.

Lossow, Walter von, "Mission-Type Tactics versus Order-Type Tactics," Military Review, June 1977, pp. 87-91.

Mahaffey, Fred K., "C3I For Automated Control of Tomorrow's Battlefield," Army Magazine, March 1979, pp. 26-30.

Mc Clow, Donald, Rogers, Douglas, H., and Wright, Erick, "Army Weaponry and Equipment," Army Green Book, Oct 1988, pp. 312-456.

Moten, Matthew, "CAMBS A Better Solution," Infantry, Sept-Oct 1988, pp. 13-15.

Mullen, William, J. III, "Comand Continuity On The Airland Battlefield," NTC Lessons Learned, 31 Jan 1988.

Paparone, Christopher, R., "Overcoming Threats To The

Bde Support Area," Army Logistian, May-June 1988,
pp. 32-38.

Prillamen, Richard L., "Command and Control in the 2D
Armored Division," Military Review, July 1982.

Prior, David, A., "EPLRS Where Are You? I am Here,"
Infantry, Sept-Oct 1988.

Schmidt, Robert L., "A Doctrine for Command," Military Review, Nov 1985, pp. 45-47.

Silva, Jack, "Improving CP Survivability," Infantry, Nov-Dec 1987, pp.23-27.

Spigelmire, Michael, F., and Tuttle, Henery, S., "BCTP
and The Victory Division," Military Review, Oct 1988, pp. 20-26.

Starry, Donn A., "Command and Control: An Overview,"
Military Review, Nov 1981, pp. 2-3.

Teston, Harvey A. Jr., "Command and Confusion at NTC,"
Military Review, Nov 1985, pp. 56-64.

Thurman, Maxwell, R., "Combat Training Center and Battle
Command Training Programs Put Leaders and Soldiers
To The Test," Army Green Book, Oct 1988, pp. 88-89.

Thurman, Maxwell,R., "TRADOC Prepares For The Future:
Training to Fight and Win, Now and Beyond The Year
2000," Army Green Book, Oct 1988, pp. 83-97.

Timmerman, Frederick W. Jr., "Of Command and Control and
Other Things," Army Magazine, May 1985, pp. 55-58.

Verdier, Bernard L.J. and Porrecca, David F., "The
Command and Control System of the Future--Now,"
Military Review, Nov 1981, pp. 63-70.

Wass de Czege, Huba, "Challenge For the Future:
Educating Field Grade Battle Leaders and Staff
Officers," Military Review, June, 1984.

Wetzel, Robert L., "Command and Control in the NATO
Environment," Military Review, Nov 1981, pp. 10-18.

Zawilski, Robert W., "Computers: An Aid to Command and
Control," Military Review, Dec 1981, pp. 51-56.

Theses, Studies, and Other Papers

Burgdorf, Charles E., "The Right Place at the Right Time," SAMS Monograph. Ft. Leavenworth, Ks., 17 Nov 1986.

Burkhardt, Robert W., "Brigade Organization and the AirLand Battle," SAMS Monograph. Ft. Leavenworth, Ks., 2 Dec 1985.

Campbell, Julian, M. Jr., The Command Post On The Modern Battlefield. Unpublished, Ft. Leavenworth, Ks., 1982.

Cushman, John, H., Organization and Operational Employment of Air/Land Forces. Carlisle Barracks, Pa., 16 Jan 1984.

Debastiani, Richard J., "Computers On The Battlefield: Can They Survive?", National Security Affairs Monograph. Washington, D.C., 1983.

DTAC CGSC, "3AD BCTP AAR," Unpublished Action Officer MFR. Ft. Leavenworth, Ks., undated.

Doughty, Robert, A., "The Evolution of U.S. Army Tactical Doctrine, 1946-76," Monograph. Ft. Leavenworth, Ks., Aug 1976.

Fincke, Dale E., "Principles of Military Communications For C3I," SAMS Monograph. Ft. Leavenworth, Ks., 20 May 1986.

Garber, William B., The Art of Command and Control in Mechanized Task Force Offensive Operations. U.S. Army War College: Carlisle Barracks, Pa., April 1986.

Holder, Don. III Corps Maneuver Booklet. Ft. Hood, Tx., May 1987.

Hooper, Thomas, A., "The Principles of War and Rear Area Protection: Have We Achieved Economy of Force?", SAMS Monograph. Ft. Leavenworth, Ks., 17 Jan 1988.

Krysa, John C., "Tactical Command and Control in the Combined Arms Bn Task Force," SAMS Monograph. Ft. Leavenworth, Ks., 8 March 1988.

Leland, E.S., Jr., "NTC Observations," Letter. Ft. Irwin, Ca., 20 Nov 1985.

McGinnis, Thomas, M., "Continuous Operations The Time Dimension of Battle." SAMS Monograph. Ft. Leavenworth, Ks., April 1986.

Pennypacker, William, S., "Automation: The Commander's Key to Victory in the AirLand Battle or Another Source of Friction?," SAMS Monograph. Ft. Leavenworth, Ks., 30 Nov 1987.

Rios, Leon H., "Will, Technology and Tactical Command and Control," SAMS Monograph. Ft. Leavenworth, Ks., 6 Dec 1985.

Romjue, John L., "From Active Defense to Airland Battle: The Development of Army Doctrine 1973-1982," TRADOC Historical Monograph Series. Washington, D.C., Sept 1984.

Runals, Stephen E., "Command and Control," SAMS Monograph. Ft. Leavenworth, Kansas, 2 Dec 1985.

Swain, Richard, M., ed., Glossary of Military Terms, Ft. Leavenworth, Ks., undated.

Willbanks, James H., "AirLand Battle Tactical Command and Control," SAMS Thesis. Ft. Leavenworth, Ks., May 1984.

Manuals and After Action Reports

After Action Report: FTX REFORGER 87, Center For Army Lessons Learned: Ft. Leavenworth, Ks., 24 Feb 1988.

After Action Report: FTX REFORGER 86, Center For Army Lessons Learned: Ft. Leavenworth, Ks., 22 May 1986.

After Action Report: Central Guardian-REFORGER 85, Center For Army Lessons Learned: Ft. Leavenworth, Ks., 15 Mar 1985.

After Action Report: 1AD FTX Certain Iron, Center For Army Lessons Learned: Ft. Leavenworth, Ks., 10 May 1985.

Brigade Operations, Briefing Slides, Center For Army Lessons Learned: Ft. Irwin, California, September 1988.

Bulletin No. 1-86, Center For Army Lessons Learned, Ft. Leavenworth, Ks., July 1986.

Bulletin No. 2-88, Center For Army Lessons Learned, Ft.

Leavenworth, Ks., June 1988.

Bulletin No. 3-88, Center For Army Lessons Learned, Ft. Leavenworth, Ks., July 1988.

Doctrine and Training Pamphlet: Mobile Subscriber Equipment, Non Signal Doctrine and Tactics Training, U.S. Army CGSC, Ft. Leavenworth, Ks., Nov 1987.

Doctrine and Training Pamphlet: Mobile Subscriber Equipment, Non Signal Doctrine and Tactics Training Supplemental Handout, MSE and The Battlefield Operating Systems, U.S. Army CGSC, Ft. Leavenworth, Ks., Feb 1988.

NTC Lessons Learned, CATA, Ft. Leavenworth, Ks., 31 Jan 1986.

NTC Lessons Learned, CATA, Ft. Leavenworth, Ks., 1 May 1986.

NTC Lessons Learned, CATA, Ft. Leavenworth, Ks., 1 Sep 1986.

NTC Lessons Learned, CATA, FT. Leavenworth, Ks., 27 Feb 1987.

NTC Lessons Learned, CATA, FT. Leavenworth, Ks., 1 July 1987.

NTC Lessons Learned, CATA, Ft. Leavenworth, Ks., 31 Jan 1988.

NTC Lessons Learned, CATA, Ft. Leavenworth, Ks., 27 May 1988.

NTC Lessons Learned: Commander's Comments-The CS Team, Ft. Leavenworth, Ks., 1987.

NTC Lessons Learned: Commander's Comments-The CSS Team, Ft. Leavenworth, Ks. 1986.

United States Army, Army C2 Master Plan(U) Vol I: Concepts and Management. CACDA: Ft. Leavenworth, Ks., Oct 1987.

United States Army, Command & Control System Program Review-Panel II: C2 Now 1982-83. Briefing, Ft. Leavenworth, Ks., 14 Dec 1981.

United States Army, ARTEP 71-3-MTP Heavy Brigade Command

Group and Staff Army Training And Evaluation Program Mission Training Plan (MTP) (Final Draft), Washington, D.C., July 1988.

United States Army, FC 71-3 The Armor and Mechanized Infantry Brigade (Coordinating Draft), Ft. Knox, Ky. and Ft. Benning, Ga., October 1985.

United States Army, FC 71-6 Battalion and Brigade Command and Control, Ft. Knox, Ky. and Ft. Benning, Ga., 1 March 1985.

United States Army, FC 71-100 Armored and Mechanized Division and Brigade Operations, Ft. Leavenworth, Ks., May 1984.

United States Army, FC 101-5-2 Staff Officers Handbook, Ft. Leavenworth, Ks., March 1987.

United States Army, FC 101-55 Corps and Division Command and Control, Ft. Leavenworth, Ks., 28 Feb 1985.

United States Army, FM 22-100 Leadership, Washington, D.C., 31 Oct 1983.

United States Army, FM 71-3 Armored and Mechanized Infantry Brigade, Ft. Knox, Ky., May 1988.

United States Army, FM 100-2-1 The Soviet Army: Operations and Tactics, Washington, D.C., 16 July 1984.

United States Army, FM 100-5 Operations, Washington, D.C., 22 May 1941.

United States Army, FM 100-5 Operations, Washington, D.C., 5 May 1986.

United States Army, FM 101-5 Command and Control For Commanders and Staff (Coordinating Draft), Ft. Leavenworth, Ks., May/June 1988.

United States Army, TC 101-5 Staff Techniques and Procedures To Support Command and Control (Draft), Ft. Leavenworth, Ks., 1 Aug 1988.

United States Army, FM 101-10-1/1 Staff Officers' Field Manual: Organizational Technical, and Logistical Data (Volume 1), Washington, D.C., 7 October 1987.

United States Army, TOE 87042L200 (Base), CACDA, Ft. Leavenworth, Ks., 29 August 1988.

United States Army, TOE 87042L200 (Objective), CACDA,
Ft. Leavenworth, Ks., 30 Aug 1988.

United States Department of Defense, U.S. Department of
Defense Dictionary of Military Terms, New York, New
York: Arco, 1988.